AFRL-HE-BR-TP-1999-0002

UNITED STATES AIR FORCE RESEARCH LABORATORY

JOINT UNDERGRADUATE NAVIGATOR TRAINING (JUNT) PRELIMINARY EVALUATION REPORT

Catherine A. Connolly

GALAXY SCIENTIFIC CORPORATION
7334 Blanco Road, Suite 206
San Antonio TX 78216

Terresa E. Jackson

HUMAN EFFECTIVENESS DIRECTORATE
WARFIGHTER TRAINING RESEARCH DIVISION
INFORMATION TRAINING BRANCH
7909 Lindbergh Drive
Brooks AFB TX 78235-5352

Edward Arnold

GLOBAL INFORMATION SYSTEMS
TECHNOLOGY, INC.
100 Trade Centre Dr, Suite 301
Champaign, IL 61820

April 1999

19991117 063

NOTICES

When the Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the government may have formulated or in any way supplied the said drawings, specifications or other data is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder, or any other person or corporation; or as conveying any rights or permission too manufacture, use, or sell any patented invention that may in any way be related thereto.

The Office of Public Affairs has reviewed this paper, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This paper has been reviewed and is approved for publication.

TERRESA E. JACKSON, DR-II
Program Manager

R. BRUCE GOULD
Technical Advisor
Warfighter Training Research Division

REPORT DOCUMENTATION PAGE

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE April 1999	3. REPORT TYPE AND DATES COVERED Final Report – July 1997 – October 1998

4. TITLE AND SUBTITLE

Joint Undergraduate Navigator Training (JUNT) Preliminary Evaluation Report

5. FUNDING NUMBERS

C – F41624-95-D-5005
PE – 62205F
PR – 1123
TA – A3
WU – 12

6. AUTHOR(S)

Catherine A. Connolly
Terresa E. Jackson
Edward Arnold

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Galaxy Scientific Corporation
7334 Blanco Road, Suite 206
San Antonio, TX 78216

Global Information Systems Technology, Inc
100 Trade Centre Dr, Suite 301
Champaign, IL 61820

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Air Force Research Laboratory
Human Effectiveness Directorate
Warfighter Training Research Division
Information Training Branch
7909 Lindbergh Drive
Brooks Air Force Base TX 78235-5352

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
AFRL-HE-BR-TP-1999-0002

11. SUPPLEMENTARY NOTES
Air Force Research Laboratory Technical Monitor: Ms Terresa E. Jackson, (210) 536-3908.

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

The goal of this project is to empirically test the efficacy and generalizability of various instructional strategies for automated instruction within an operational Air Force environment, namely the Joint Undergraduate Navigator's Training (JUNT) School located at Randolph Air Force Base, Texas. This paper outlines the instructional strategies selected to be implemented into the tutor, the experimental design and the formative and summative evaluation strategies.

14. SUBJECT TERMS
Undergraduate Navigator Training, desktop simulation, simulation, VIVIDS authoring system, dyadic protocol, collaborative learning, dynamic graphical model, Elaboration Theory

15. NUMBER OF PAGES
44

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL

CONTENTS

INTRODUCTION

Research has been conducted to determine a multitude of effective instructional strategies. There has also been much research over the past few years in the field of advanced instructional technologies, i.e., digital video interactive, multimedia, hypermedia, CD-ROM, internet, distance learning and adaptive training among others. These types of systems have not been fully explored with relevance to intelligent modeling of instructional strategies. How these instructional strategies are used most effectively in an automated structure is the next step in this research and the purpose of this research program. This program will provide the Air Force, other services, industry, and the public with the capacity to cost effectively develop, deliver, and evaluate instruction more appropriate to specific training situations.

Armstrong Laboratory and The Air Force Office of Scientific Research jointly sponsor a research laboratory at Lackland AFB studying the pedagogy of automated instruction. The Training Research for Automated Instruction (TRAIN) laboratory at Lackland AFB conducts basic research in this area developing and validating automated instructional approaches in Air Force domains, based on instructional approaches emerging from TRAIN and other laboratories. These prototype instructional approaches will include part-task trainers, intelligent tutoring systems, digital video interactive, hypermedia, and multimedia environments. Once this research is completed, knowledge of how to use instructional strategies to instructional technology will enable the Air Force to train its personnel far more effectively and efficiently. The Air Force will also be in a position to transition this technology into industry and the public sector making training and education fundamentally more reliable and effective.

Background

The 619th TRSS Curriculum Squadron requested help from Armstrong Laboratory in upgrading their radar course, specifically the initial introductory level lessons. The students are Air Force and Navy officers learning standard aircraft navigation. The initial UNT academic classes were designed as standup instruction with text materials. Students learn how to use the radar simulator on paper before being placed on the simulator and being required to know how to make it function. The simulator room presents the students with a high stress situation.

The students need to know how to work the simulator before having to face it for the first time. We developed the first six lessons (11 hours) in the Navigational Radar Course to teach set controls, checklist procedures, azimuth stabilization, radarscope interpretation, and dead reckoning navigational procedures. The lessons were designed around a specific set of instructional strategies and developed within an interactive simulation environment on a desktop computer.

Many instructional strategies have been designed, tested and validated within the Training Research for Automated Instruction (TRAIN) laboratory, as well as, other laboratories with the Department of Defense and academia. Whether these strategies are robust enough or can be generalized to operational environments where extraneous variables such as the skill level of the user, and environmental variables such as noise and

variables such as the skill level of the user, and environmental variables such as noise and stress are not controlled is the second step in the implementation of an instructional strategy. Regian and Shute (1993) point out the importance of initially developing and testing pedagogical principles in a laboratory setting then progressively more field-like settings to ensure both internal and external validity.

Instructional Strategies

Four instructional strategies were selected for inclusion into the JUNT tutor. They are as follows: Instructional Sequencing based on the Elaboration Theory, Dynamic graphics, Group Learning (Dyadic) Protocols, and Learner Directed Instruction. Reigeluth's Elaboration theory prescribes an instructional presentation format that begins with an overview of the fundamental ideas/ concepts followed by elaborations of those concepts and finally end with a summary and synthesis of those concepts. This initial overview will also act as an advanced organizer for the students.

The second strategy is the use of a dynamic graphical model to facilitate the student's conceptualization of the system. As students manipulate console panel indicators, a dynamic simulation of the cause and effects of their actions is presented.

The third strategy included in this tutor is actually not embedded within the software itself, but rather in the method of instruction. Pairing students together on each computer and allowing them to interact while learning the course material is termed "dyadic protocol." The use of this group protocol using a cooperative learning procedure has an observational to performance ratio of 50-50%. Students will be required to participate as both an observer and as a performer equally.

And finally, the fourth instructional strategy to be used is learner directed instruction. We believe that this will temper the lock step presentation method of sequencing the instruction. Because of the highly motivated nature of the target audience, we believe that an effective organization of the presentation of the series of graphical simulations followed by learner-directed instruction will allow the student to master the objectives. The VIVIDS authoring system developed by the Air Force Research Laboratory was used to develop simulations and practice exercises.

Now that the course and instructional strategies have been spelled out, we begin with an overview of the evaluation.

Evaluation Goals

- To conduct a formative and summative evaluation of the courseware.
- Provide theoretical rational for evaluation approach.
- Propose analysis plan to collect and analyze evaluation data.
- Develop on-line criteria based on learning objectives.

- Specify and develop on-line affective measures for: instruction, tutor and interface
- Conduct a formative and summative evaluation of courseware.
- Assess impact on in-training student performance.
- Assess impact on subsequent schooling and job performance (simulator and on the job if possible).

This evaluation will compare the effectiveness of an automated instructional course using four instructional strategies to that of the traditional classroom instruction. Effectiveness is defined as increases in student knowledge and performance and a decrease in overall training time. Student knowledge differences will be measured cumulatively and by type (declarative, procedural and conceptual) on an end of course test (sections 2-7 only). Differences in student performance will be measured using quantitative and subjective data reported by instructors obtained on subsequent simulator exercise trails that take place approximately 1 week after course sections 2-7 are taught. Differences in training time will be based on the amount of time students spent in the automated JUNT course versus the traditional classroom. And finally, affective surveys will be administered to the student to measure their opinions and preferences toward the instruction that they were given.

Hypotheses

We hypothesize that the tutor using the elaboration theory, dynamic graphics, dyadic protocol, and learner directed instructional strategies will result in superior knowledge as measured by an end of course test, and superior performance as measured by objective and subjective criteria based on the simulator exercises. Moreover, we believe that the increase in student knowledge and performance will occur in significantly less time and students will prefer the automated instruction to that of the traditional classroom instruction.

METHODS

Experimental Design

This experiment is based on a between subjects, pre and posttest design with repeated measures. The independent variables in this study are traditional classroom instruction versus automated instruction for an Air Force undergraduate radar systems training course at Randolph Air Force Base. Only the instruction for blocks two through seven are being evaluated in the current study. The instruction in the automated treatment condition is self-paced while the classroom group meets six times for approximately four hours each. The instructor for the classroom is a retired Officer who has approximately 10 years experience as a navigator. All instructors for this course are hired as contractors and are required to be re-certified as instructors by the Air Force every year.

The dependent variables of interest are the learning indicators as measured by the pretest and posttest, affective measures about the student's preferences for either mode of instruction, learning time and a conceptual survey. The pre/posttests were constructed based on the course objectives and were reviewed by subject matter experts to ensure plausibility and correctness. The affective questionnaires surveys student's attitudes about the instructor or tutor's effectiveness in presenting the information (e.g. Did the instructor keep you motivated?). Demographic information about the students' background training and experience is also being collected to be used as possible covariates. Two test forms were developed to serve as the pre and posttests. The test forms were administered in a counterbalanced fashion, that is, if a student had form A for the pretest they would be administered form B for the posttest and vice versa. Following the initial administration the tests will be analyzed to ensure that they are parallel in terms of difficulty.

Because students in each class are rank ordered and placed into duty assignments based on their ranking, we were not able to conduct a within groups experimental design. In order to be fair, all students in each class had to receive the same training. Thus, four consecutive classes will be run for each treatment condition. Each of the eight groups will receive a privacy right act form, a demographic questionnaire, pretest and conceptual survey prior to instruction on this block of the course. Following the instruction, whether it was automated or in the traditional classroom, everyone will receive a posttest, the conceptual survey and an affective questionnaire. The affective questionnaires are identical for the two treatment conditions differing only in reference to the tutor or instructor (e.g. Did the tutor keep you motivated?). The conceptual survey administered prior to and following the instruction is the same for each group and administration. Within this survey, pairs of concepts pertinent to the course material are presented and students are asked to rate their relatedness based upon a five point Likert scale. Changes in students' ratings before and after instruction and their similarity to the expert's conceptual model will be analyzed.

Equipment/Task

Classroom

Students within the traditional classroom treatment received instruction from an experienced, certified instructor. Different instructors however taught each of the four classroom groups. All instructors had 5 or more years experience as a navigator within a branch of the Department of Defense. In addition, yearly certification procedures are used to test and ensure the instructor's knowledge in the subject area of navigation as is required by the school. The classroom instruction took a total of 30 hours, with approximately 6 hours across 5 days. In addition, students are assigned homework reading assignments prior to the beginning of each class (including the first class). The classroom instruction encompasses verbal instruction paired with Powerpoint color

presentations or a large scale mockup of the console panel, radarscope console panel practice and radarscope presentation slides.

JUNT Tutor

While the instructor was used within this treatment as a facilitator in answering questions about the tutor's interface or questions that the students did not understand within the instruction, most of the information covered in lessons 2 through 7 was presented via the computer. The class began with the instructor introducing themselves and giving the same brief motivational speech to the classroom students. Next students were randomly paired together and placed at a computer station. A total of 8 computer stations were available for use. Students were lead through instruction about the tutor's interface and given an instruction sheet on the interface for future reference. The students were instructed to progress through lessons 2 through 7 at their own pace. In addition, students were instructed to work together in understanding the material and to switch positions in "driving" through the tutor's presentation at the end of each lesson. The software was written using a authoring system called VIVIDS and delivered on high-end INTEL 80486 PC's running LINUX.

Procedures

All students began the experiment by reading the privacy right act (see Appendix A) and filling out a demographic questionnaire (see Appendix B) that asked questions about their age, educational background and experience as a pilot and navigator. Next, students were asked to read over the pretest instructions (see Appendix C) and complete a 50 item multiple choice and fill in the blank pretest. Two parallel forms of the test were created and counterbalanced as a pretest and a posttest (see Appendix D and E). Initial results indicate that the two tests were indeed parallel in form based upon the first administration. Once the students had completed the pretest they were given a motivational speech by the instructor and began instruction on Lesson 1 of the JUNT course. Following the instruction and a brief question and answer period to assess their knowledge by the instructor, classes either continued with the traditional classroom instruction or where placed on the JUNT tutor for further instruction. Following the instructional phase of the study students were again given the counterbalanced form of the 50 item pretest, which now served as the posttest. In addition students were asked to respond to an affective questionnaire about their opinions and preferences for the two forms of instruction (see Appendix F and G). Again, care was taken so that each questionnaire surveyed identical information from the students but were tailored to be in keeping with either form of instruction.

PRELIMINARY RESULTS

Sample Characteristics

A total of 75 subjects participated in the classroom treatment group. Of these, approximately 82 % of the students in the classroom treatment group have been males and 6 % have been female students. The remaining 12 % did not indicate their gender on the background survey. Likewise 87 % of the sample has a baccalaureates degree while 6 % indicated they hold a master's level degree. Two percent indicated they held an Associate's degree and 6 % did not indicate their education level on the survey. The average age was 24.67 years (SD = 2.44 years) with the youngest student being only 22 years of age and the oldest being 30 years of age.

It is interesting to note that almost 77 % of the students are active duty Navy officers and 18 % are active duty Air Force officers. Four percent were officers from a Foreign country. These officers come from a wide variety of commissioning sources including;

1.	OTS	0 %
2.	Naval Academy	27.5%
3.	Air Force Academy	17.6 %
4.	University ROTC	29.4 %
5.	NCO	3.9 %
6.	OCS	13.7 %
7.	Other Sources	5.9 %

Homework

Almost three-fourths (72.5%) of the students indicated that they had not read their homework assignment for chapters 1 & 2 prior to the pretest. Although we were initially worried that their reading of the chapters prior to the pretest would create a potential ceiling effect in the data, the data does not indicate this to be a problem.

Background Experience

Pilot

Over one-fourth (29%) of the students indicated they had experience as a pilot prior to enrolling in this course. Of those that did indicate they had prior experience, the

Over one-fourth (29%) of the students indicated they had experience as a pilot prior to enrolling in this course. Of those that did indicate they had prior experience, the average number hours spent in flight was 52.13. There was a large degree in variation between the number of flight hours (min = 18, max. = 257) thus, the median score (MD=35.0) may serve as a better indicator of the sample for flight hours.

Navigator

Almost one-third (31 %) of the students indicated that they have some navigator's experience prior to enrolling in this course. This is not surprising since most (78 %) of the students are from the Navy which often sends their students through the Pensacola Flight Instruction School. Of the students that indicated they had prior navigational experience, the average number of hours spent as a navigator was 16.96. We believe that this variable may also be used as a possible covariate in the final analyses to control for incoming differences between students.

Pretest Data & Posttest Data

Out of a possible 50 items, the average score on the pretest was just under half at 44.78 % (SD= 10.17). The posttest was the alternate form of the pretest again consisting of 50 items. The average score for students in this class on the posttest was 68 % (SD = 12.92). Amazingly enough almost 1/3 of the items are still being answered incorrectly after being instructed in the classroom. The highest score obtained on the test was a 90% while the lowest score was a 33%. Pretest scores were evaluated by DoD membership and no significant differences were found between the Air Force students (X = 42.67%, N= 24) and the Navy students (X = 45.87%, N= 47). Similarly, no significant differences were observed on the posttest scores between either the Air Force students (68.67%) or the Navy students (68.25%).

CONCLUSION

As this evaluation report is preliminary in nature, the pretest and posttest data reflect the classroom environment without the computer instruction. Student data from the computer-based training has not been collected for this report. The tutor design is undergoing enhancements and the classroom for the computer training is being prepared with hardware upgrades.

REFERENCES

Justen, J. E., Waldrop, T. M., & Adams, T. M. (1990). Effects of paired versus individual user computer-assisted instruction and type of feedback on student achievement. *Educational Technology, 30* (7), 51-53.

Regian, J. W. & Shute, V. J. (1993, April). An investigation of virtual reality for training visual-spatial tasks. *Annual Meeting of the American Educational Association,* Atlanta, GA.

Shute, V. J., Lajoie, S. P., & Gluck, K. A. (in press). Individualized and group approaches to training. To appear in S. Tobias & D. Fletcher (Eds.), *Handbook on Training.*

Yadrick, R. M., Regian, J. W., Connolly-Gomez, C., & Robertson-Schule, L. (Submitted). Individual and dyadic learning with a passive and an interactive mathematics tutor. *Journal of Computer-Based Instruction.*

Appendix A

PROVISIONS OF THE
PRIVACY ACT

Authority
10 U.S.C. 8012 Secretary of Air Force, Powers, duties, Delegation by compensation: and E09397, 22 Nov 43, Numbering System for Federal Accounts Relating to Individual Persons.

Principal Purposes
These tests will be used for armed services selection system's development purposes. Use of the Social Security Account number is necessary to make positive identification of you and your records.

Routine Use
Information provided by you will be treated as confidential and will be used for official purposes only. Individual identity will not be revealed. Regardless of whether you are identified by name and/or SSAN, the information obtained will be used only to improve selection, classification, assignment, and evaluation techniques within the armed services personnel system.

Disclosure Requirement and Effect of Not Providing Information
Disclosure of this information is voluntary. Failure to provide information would hinder the armed service's ability to improve the effectiveness of the personnel system. The personnel system continues to improve only with your assistance to make additional refinements in policies and procedures. Your cooperation in this effort is appreciated.

JUNT TRAINING BACKGROUND QUESTIONNAIRE

We are collecting information about your training background. Please indicate your answer by circling the appropriate letter or indicating your response on the line provided..

JUNT Student Number: _____   Date: _____

Gender (circle one):   Male   or   Female   Age: _____

Highest Education level achieved (check one):

High School   Associates Degree   Bachelors Degree   Masters Degree   Doctorate

1. Which branch of the Armed Forces are you a member of?
    Air Force
            a. Active Duty
            b. Guard
            c. Reserve
    Navy
            d. Active Duty
            e. Guard
            f. Reserve
        g. Other: _____

2. Where were you commissioned as an officer?
        a. Officer Training School (OTS)
        b. Naval Academy
        c. Air Force Academy
        d. University ROTC
        e. Not commissioned as an officer
        f. Other: _____

3. Have you ever had any training as a pilot? If your answer is No, skip to question 7.
        Yes   or   No

4. Where did you receive training as a pilot?
        a. Air Force Academy
        b. Naval Academy
        c. Commercial Pilot Course
        d. Other: _____

5. What type of plane(s) did you train on as a pilot? (If there were more than one, please list all of them .)

_____

_____

6. Approximately how many hours did you fly in each of these planes as a pilot? (Please indicate plane type as well as number of hours.)

_____

_____

7. Prior to entering this course, have you ever had any training as a navigator? If your answer is No, then you are finished with the questionnaire.
   a. Yes   b. No

8. Where did you receive your previous training as a navigator?
   a. Air Force Academy
   b. Naval Academy
   c. Commercial Pilot Course
   d. Other: _____

9. What type of plane(s) did you train on as a navigator? (If there were more than one, please list all of them):

_____

_____

10. Approximately how many hours did you fly in this/these plane(s) as a navigator? (Please indicate plane type as well as number of hours.)

_____

_____

Appendix C
Answer Sheet

JUNT Student Number: _____   Date: _____

Test Administration (circle one):   Pretest   or.   Posttest

Test Form (circle one):   A   or   B

We are currently evaluating how much of the course information to be presented to you in Lessons 2 through 6 you will be able to learn. You will be given both a pretest prior to the instruction of these lessons and a posttest following the instruction of these lessons. The pretest will evaluate how much of the information you may already know. We do not EXPECT you to know this information. If you do not know the answers to these items, make your best educated guess. Upon the completion of lesson 6, we will test you again to evaluate how much you have learned. The information gained from these tests will help us modify future instruction, but will not have a bearing on your rank in the JUNT course.

You may use either a pen or pencil to mark your answers. Please write your answer to each test item on the blank provided below. Write ALL answers on this answer sheet. Do NOT write on the test itself. You may use the space provided on the bottom and back of this sheet for any comments you wish to make in reference to this test. When you finish this test, sit quietly at your desk and wait for the rest of the class to finish. The instructor will come around to collect your test when everyone is done.

1. _____   16. _____
2.a. _____   17. _____
   b. _____   18. _____
   c. _____   19. _____
   d. _____   20. _____
3. _____   21. _____
4. _____   22. _____
5. _____   23. _____
6.a. _____   24. _____
   b. _____   25. _____
   c. _____   26. _____
   d. _____   27. _____
   e. _____   28. _____
   f. _____   29. _____
   g. _____   30. _____
   h. _____   31. _____
                        32. _____
7. _____   33. _____
8. _____   34. _____
9. _____   35.a. _____
10. _____   b. _____
11. _____   c. _____
12. _____   d. _____
13. _____   e. _____
14. _____   f. _____
15. _____

Comments:

Appendix D

<u>Form A</u>

Please use the answer sheet provided to answer each item. Do NOT write on this test.

1. The _____ can be adjusted from -15 degrees to +10 degrees to optimize target return.
a. Gain Control
b. * Tilt Control
c. Bezel Intensity Control
d. Antenna Control

2. Using the figure below, match each title with its associated control.
_____ a. STAB Switch
_____ b. Beam Switch
_____ c. Scan Mode Selector
_____ d. Sector Bearing MAN Control
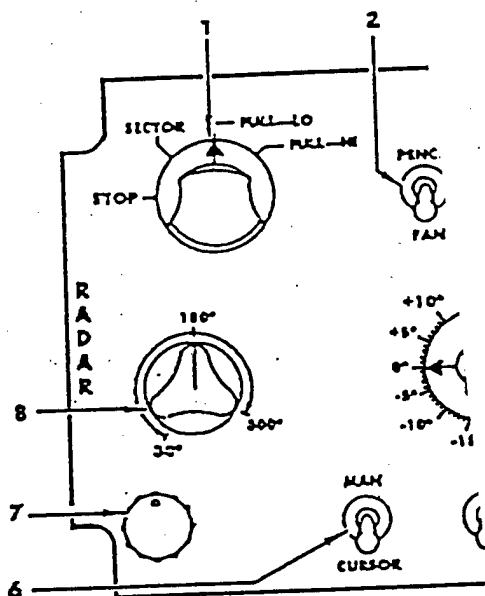
Radar Antenna Control Panel

3. What does the RF power light indicate in the ON position?
a. *RF energy is NOT being transmitted through the antenna
b. RF energy is being transmitted through the antenna
c. The antenna is ready to transmit
d. The antenna is beginning warm-up cycle

17

4. What does the transmitter agile switch indicate in the ON position?
a. Fixed frequency is set by the XMTR frequency selector
b. *Variable frequency pulses are being transmitted
c. Short range returns are being reduced
d. Magnitude of attenuation has been activated

5. The radar presentation is accurate within _____ NM and representative beyond that range with the ISO ECHO selected.
a. 10
b. 25
c. *40
d. 50

6. Using the figure below, match each title with its associated control.
_____ a. Sweep Intensity Control
_____ b. VAR Range Control
_____ c. Radar Range Group Status Lights
_____ d. Lamp Switch
_____ e. Bezel Intensity Control
_____ f. Heading Marker Intensity Control
_____ g. Sector Origin Switch
_____ h. Focus Control

Radar Indicator Panel

18
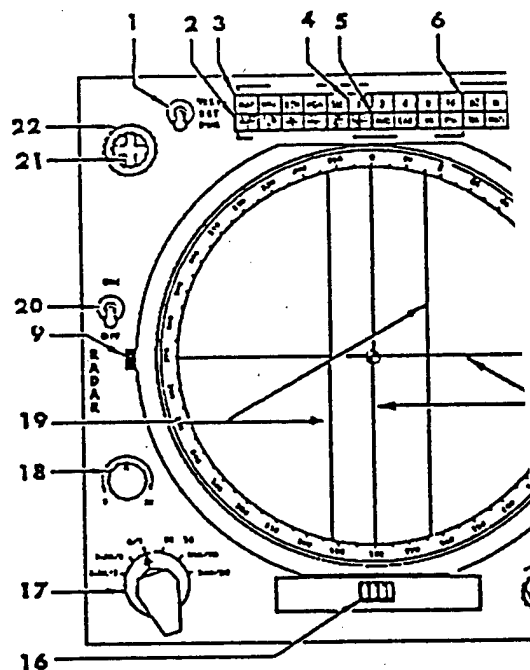
7. Which control enables an expanded presentation of radar targets about the range cursor?
a. Reticle
b. Sector Origin Switch
c. *Range Delay Switch
d. Mechanical Cursor

8. The range selector is used to select one of _____ range scales for viewing radar targets.
a. 2
b. 4
c. 5
d. *6

9. What procedure, if any, would be followed if the radar pressure gauge reads 45 Hg?
a. * Press Bleed Switch
b. Press Momentary On switch
c. Press Off switch
d. Does not require action

10. The constant use of _____ can result in a prematurely degraded radar presentation.
a. Transmitter Frequency Selector
b. *Transmitter Frequency
c. VAR Range Control
d. Scan Mode Selector

11. What condition in the instrumentation function may occur due to moisture?
a. ISO Echo Light may flicker
b. *Radar Set Control Status/Fail R/T light may come on
c. Heavy Weather Indicator Light may come on
d. Radar Status/Fail Light may come on

12. After aircraft landing, the RF power switch should be set to the _____ position as soon as possible.
a. antenna
b. off
c. *load
d. standby

13. What is the correct radar personnel radiation hazard area around the aircraft?
a. 10 ft.
b. 20 ft.
c. *40 ft.
d. 75 ft.

14. The radarscope is oriented to _____ in the track-up mode?
a. *the path of the aircraft
b. true north
c. magnetic north
d. the heading marker

15. In what direction do targets move across the radarscope as the aircraft turns to the right in the Heading-up mode?
a. In the same direction
b. Bottom to top
c. *In the opposite direction
d. Targets remain relatively stationary

16. Using the figure below, returns will move _____ during straight and level flight.
a. left to right
b. top to bottom
c. *right to left
d. bottom to top
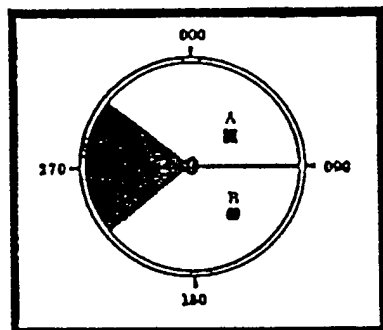
17. What is the heading marker correction (HMC) if Heading-up, TH = 090 degrees and the heading marker fires at 005 degrees?
a. +5 degrees
b. 85 degrees
c. 95 degrees
d. *-5 degrees

18. In the North-up mode, with a true heading of 150 degrees, and a heading marker of 145 degrees, what should be added or subtracted to the bearing before it is plotted?
a. -5 degrees
b. *+5 degrees
c. -/+ 0 degrees
d. +10 degrees

19. When in the heading-up mode, if the heading marker is firing at 350, the heading marker correction is _____.
a. -10
b. *+10
c. undetermined, because you need to know true heading
d. correction unnecessary, because the heading marker fires at 350

20. A rotating heading marker may represent a loss of stabilization or a _____.
a. faulty range input
b. *faulty heading input
c. change in mode selection
d. change in altitude

21. _____ is caused by the spreading of the radar beam as it passes through space.
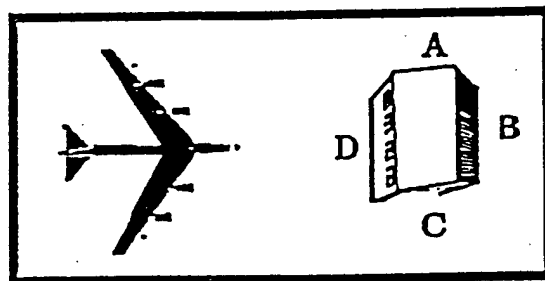a. Pulse Length Error
b. Spot Size Error
c. Slant Range Error
d. *Beam Width Error

22. The result of PLE (pulse length error) is a distortion of radar return in _____.
a. azimuth
b. *range
c. heading
d. azimuth and range

23. Using the figure below, identify which sides of the building will be affected by Spot Size Error?
a. A, C
b. D, B
c. A, B, C
d. *A, B, C, D

24. What type of error would cause two parallel highways situated 120 ft. apart to appear as one when approached at a 90 degree angle?
a. *Pulse Length Error
b. Beam Width Error
c. Spot Size Error
d. Slant Range Error

25. The distortion that is caused by electrons hitting the face of the radarscope is called _____?
a. Pulse Length Error
b. Beam Width Error
c. *Spot Size Error
d. Slant Range Error

26. Select the surface material that has the MOST reflective potential.
a. Masonry
b. *Aluminum
c. Earth
d. Wood

27. The intensity of a return varies inversely with the distance from the aircraft to a target due to _____?
a. radar ripple effect
b. cosecant-squared beam
c. angle of incidence
d. *range attenuation

28. Select the item which has the greatest reflective potential.
a. highway
b. forest
c. *dam
d. dry lake

29. Which of the following is NOT a special effect on scope presentation?
a. glitter
b. cardinal point effect
c. arctic reversal
d. *flicker

30. Cardinal point effect usually occurs when the radar beam scans _____ at right angles.
a. *buildings
b. highways
c. lakes
d. mountains

31. The ISO-ECHO function is only enabled when the radar mode selector is in _____

a. MAP
b. BCN
c. *WTHR
d. STBY

32. Which target does NOT serve well as a pointer?
a. mountain
b. large city
c. *bend in a river
d. lake

33. The first step in obtaining a radar fix is to _____.
a. choose target from chart
b. * determine your position with a DR
c. estimate range and bearing from a DR
d. establish general position from scope

34. You may need to use a _____ if the heading information is not accurate.
a. *multiple range fix
b. multiple bearing fix
c. single range and bearing fix
d. multiple range and bearing fix

35. Below are the six steps when used to take a radar fix. These steps are not in their proper chronological order. Label the steps 1-6 in their proper order.

a.__*5__   Estimate range and bearing from DR
b.__*1__   Use a manual DR to establish an approximate position
c.__*2__   Choose obvious targets from the chart
d.__*3__   Work chart to scope
e.__*6__   Now look at your scope
f.__*4__   Orient your chart to Azimuth Stabilization mode

Form B

Please use the answer sheet provided to answer each item. Do NOT write on this test.

1. The FAIL status light on the Radar Antenna Ctrl Panel could indicate failure of the_____.
a. Antenna
b. * Stabilization Data Generator
c. Electronic Control Amplifier
d. All of the above

2. Using the figure below, identify each control with its correct title.
a. _____ *Radar Antenna Control Status/Fail light
b. _____ *Tilt Control
c. _____ *STAB Switch
d. _____ *Sector Width Control
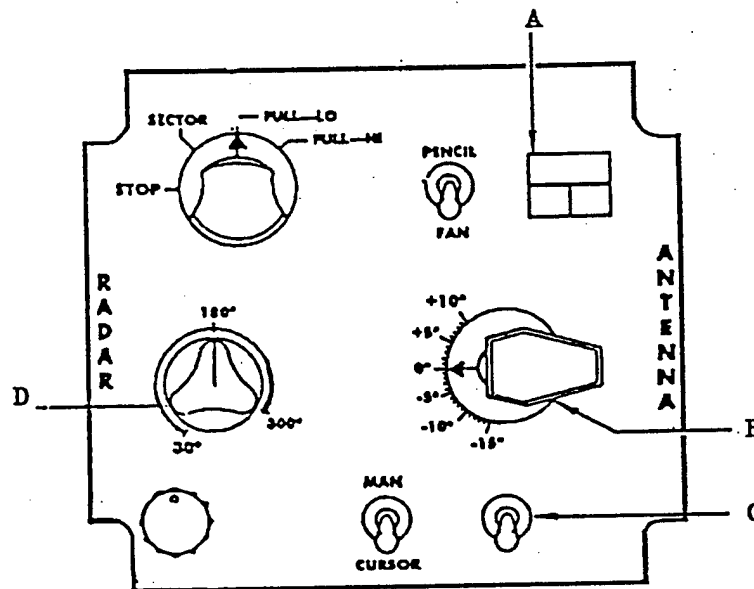
Radar Antenna Control Panel

3. During the warm-up period, the _____ is on regardless of switch position.
a. FTC Light
b. *RF PWR Light
c. XMTR Agile Light
d. Status STBY Light

4. The _____ allows increased resolution of complex targets.
a. * FTC Control
b. Mode Selector
c. XMTR Freq Selector
d. Receiver Gain Control

5. Which control is used to orient the scope to true north?
a. Reticle Control
b. AZ STAB Control
c. *MAG VAR Control
d. North Indicator Control

6. Using the figure below, match each title with its associated control.
_____ a. Range Selector (NM)
_____ b. Reticle Control
_____ c. Mechanical Cursor Control
_____ d. Cursor Intensity Control
_____ e. Mechanical Cursor
_____ f. Range Delay Switch
_____ g. Video Gain
_____ h. Range Marker Intensity Control
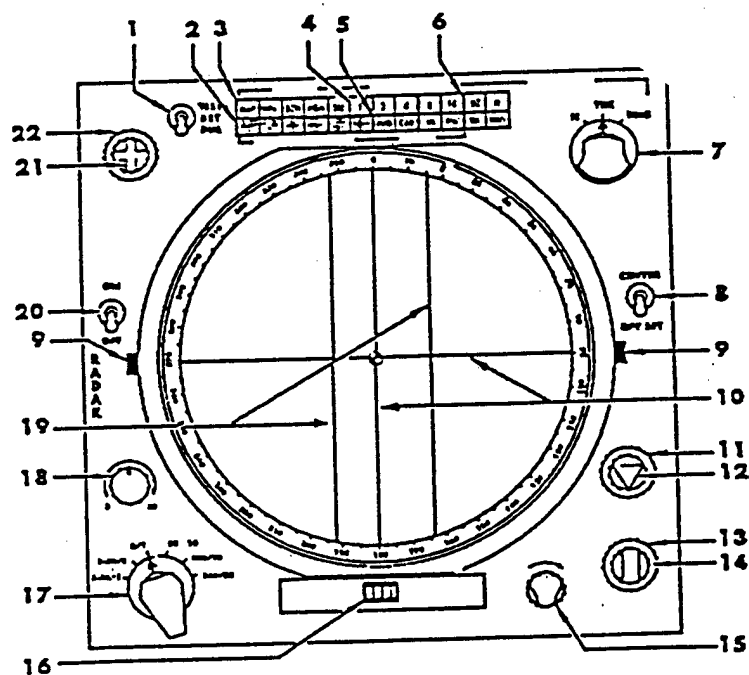
Radar Indicator Panel

7. Which control makes the presentation more uniform by dimming targets at close range?
a. *STC Control
b. FTC Control
c. STAB Switch
f. MODE Selector

8. Which control in the ON position causes azimuth to be inaccurate due to distortion?
a. Video Gain Control
b. Variable Range Control
c. Sector Origin Switch
d. * Range Delay Switch

9. When activated, the bleed switch on the Radar Pressurization Control Panel will vent the waveguide assembly to _____ .
a. 41 Hg of pressure
b. any selected pressure
c. * ambient cabin pressure
d. outside environment levels of pressure

10. Overheating of radar indicators may result if the _____ is NOT properly operating.
a. *Console Fan
b. Fail Light
c. Status Light
d. Control Modulator

11. The intercom is used to inform the pilot that "Nav is ready for Power On" upon completion of the _____.
a. Power On checklist
b. *Power Off checklist
c. Preflight checklist
d. Interior Inspection checklist

12. The RF power switch should not be placed in the ANT position until the aircraft has _____ .
a. *taxied
b. taken off
c. landed
d. stopped

13. Radar antenna system damage may occur if the _____ is turned off before the aircraft has reached final parking.
a. R/F Power Switch
b. *Mode Selector
c. Radar Press Control Switch
d. XMTR Frequency Selector

14. Using the figure below, determine what radar mode the aircraft is currently in if the TH = 90 degrees?
a. north-up
b. track-up
c. heading-up
d. *heading-up or track-up

4.3)

270
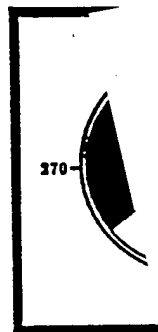
15. In what direction do targets move across the radarscope as the aircraft turns to the left in the North-up mode?
a. Bottom to top
b. In the opposite direction
c. In the same direction
d. *Targets remain relatively stationary

16. During straight and level flight, targets will move _____ to the heading marker in the North-up mode.
a. * parallel
b. perpendicular
c. in the opposite direction
d. in the same direction

17. In the Heading-up mode, a heading marker correction will correct the heading marker to _____.
a. *000 degrees
b. 180 degrees

c. a true heading
d. a north heading

18. What is the heading marker correction (HMC) if North-up, TH = 003 degrees and the heading marker fires at 359 degrees?
a. 1 degree
b. 3 degrees
c. *4 degrees
d. No correction is necessary

19. When in heading-up mode, if a correction is needed to compensate for error, apply the correction to the _____.
a. true heading
b. true bearing
c. *relative bearing
d. relative heading

20. Of the following, which is NOT a possible cause of a rotating heading marker and scope presentation?
a. Loss of azimuth stabilization
b. The aircraft is turning
c. *Erroneous fix input
d. Malfunctioning heading input

21. The result of Beam Width Error is a distortion of a radar return in _____ .
a. range
b. heading
c. *azimuth
d. azimuth and range

22. What type of error causes distortion in BOTH azimuth and range?
a. *Spot Size Error
b. Beam Width Error
c. Pulse Length Error
d. Slant Range Error

23. Using the figure below, identify which sides of the building, will be affected by Pulse Length Error?
a. A, C
b. C, B
c. *C, E
d. D, E
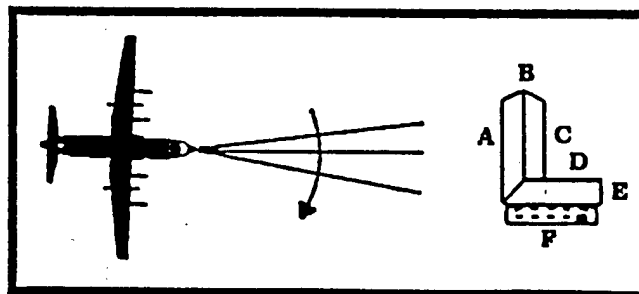
(insert figure 5.3)

24. Factors affecting radarscope presentation include ALL EXCEPT?
a. *color
b. shape
c. range
d. surface material

25. Using the figure below, determine which heading will reflect the most energy back to the aircraft?
a. oil tank
b. factory
c. *school
d. lake

A
B
C
D
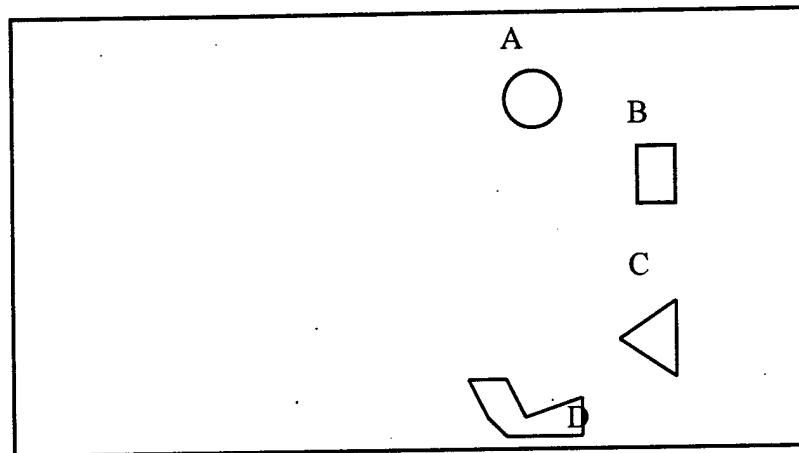
26. As the aircraft's altitude changes, you will need to adjust the radar's tilt and _____.
a. beam
b. range
c. *gain
d. azimuth

27. Land-water contrast is best depicted using a _____ gain setting.
a. low
b. *medium
c. constant
d. high

28. When the radar beam scans a relatively small reflection and forms an ideal reflective angle momentarily, it is called _____.
a. *glitter
b. flicker
c. arctic reversal
d. cardinal point effect

29. Which return creates a no show area on the radarscope?
a. an ice ridge
b. a desert
c. a highway
d. *the far side of mountain

30. The ISO-ECHO control is used to _____.
a. set intensity of returns
b. reduce magnitude of returns
c. *determine intensity of returns
d. intensify magnitude of returns

31. To identify targets on scope, always work from _____.
a. dead reckoning to fix
b. *chart to scope
c. scope to chart
d. bearing to range

32. If range marks are not available for determining a fix, then the _____ must be used.
a. single bearing fix
b. multiple range fix
c. *multiple bearing fix
d. multiple range, multiple bearing fix

33. Select the best angle between two targets for either a multi-range or multi-bearing fix.
a. 30 degrees
b. 60 degrees
c. * 90 degrees
d. 120 degrees

34. If internal radar problems with the timing generator occur, it may result in a _____.
a. loss of azimuth
b. * loss of range marks
c. loss of stabilization
d. loss of altitude

35. Below are the six steps when used to take a radar fix. These steps are not in their proper chronological order. Label the steps 1-6 in their proper order.

a.__*2___ Choose obvious targets from the chart
b.__*1___ Use a manual DR to establish an approximate position
c.__*5__ Estimate range and bearing from DR
d.__*6___ Now look at your scope
e.__*4___ Orient your chart to Azimuth Stabilization mode
f.__*3___ Work chart to scope

JUNT CLASSROOM QUESTIONNAIRE

JUNT Student Number:_____   Date:

_____

Using the scale provided below, enter the number on the blank line to the left of each question that best describes your feelings. Please use the empty space below each question to clarify your answer or provide additional information to the question.

1	2	3	4	5
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
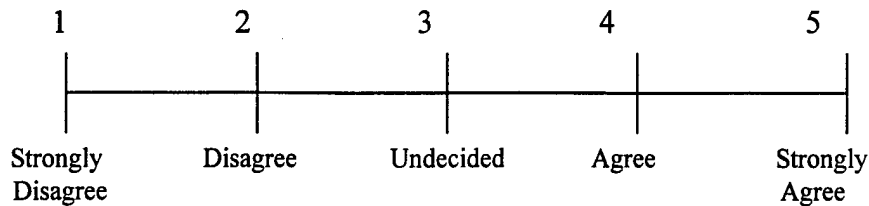
_____ 1. I *enjoyed* the course.

_____ 2. The instructor was effective in *teaching* the course material.

_____ 3. The instructor kept me *motivated.*

_____ 4. The instructor maintained my *attention* throughout the class.

_____ 5. The *objectives* of the instruction were defined adequately.

_____ 6. I was given enough *time* to finish the exercises.

_____ 7   I could use what I learned and *apply* it on the job.

_____ 8. The *sequence* of information was presented in a logical manner.

_____ 9. The *pace* of presentation was appropriate.

_____ 10. The *instructions* were clear and easy to follow.

```
    1          2          3          4          5
    |----------|----------|----------|----------|
Strongly    Disagree   Undecided    Agree    Strongly
Disagree                                      Agree
```

_____ 11. The *content* of the instruction was covered in enough detail.

_____ 12. The *practice/rehearsal* activities were in line with the objectives of the instruction.

_____ 13. I was given enough *practice/rehearsal* exercises.

_____ 14. The *help/feedback* was informative.

_____ 15. The *help/feedback* was easy to follow and understand.

_____ 16. The *help/feedback* was thorough..

_____ 17. The *procedures* were clearly described and illustrated.

_____ 18. The *information* was organized from simple to complex.

_____ 19. Would you take a course like this in the *future* given the choice?
        a. Yes   b. No

20. Use the space provided below and on the back of this sheet to comment about things that you specifically *liked* or *disliked* about the course.

## *JUNT TUTOR QUESTIONNAIRE*
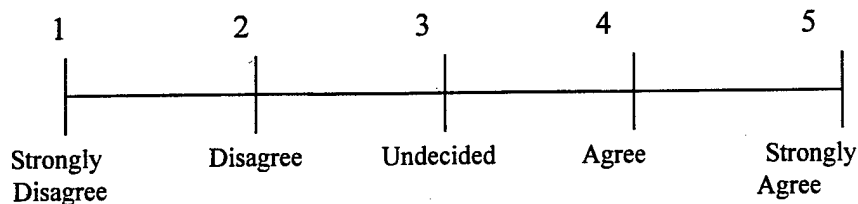
JUNT Student Number :_____Date: _____

Using the scale provided below, enter the number on the blank line to the left of each question that best describes your feelings. Please use the empty space below each question to clarify your answer or provide additional information to the question.

1	2	3	4	5
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
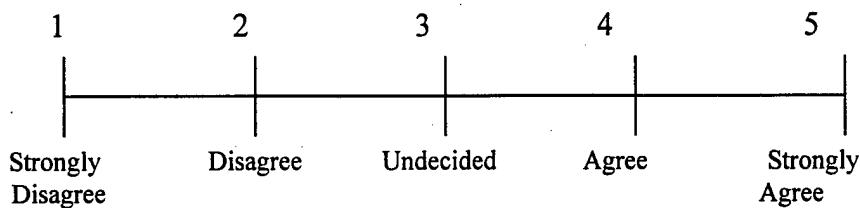
_____ 1. I *enjoyed* the course.

_____ 2. The tutor was effective in *teaching* the course material.

_____ 3. The tutor kept me *motivated.*

_____ 4. The tutor maintained my *attention* throughout the session.

_____ 5. The *objectives* of the instruction were defined adequately.

_____ 6. I was given enough *time* to finish the exercises.

_____ 7 I could use what I learned and *apply* it on the job.

_____ 8. The *sequence* of information was presented in a logical manner.

_____ 9. The *pace* of presentation was appropriate.

_____ 10. The *instructions* were clear and easy to follow.

1	2	3	4	5
Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree

_____ 11. The *content* of the instruction was covered in enough detail.

_____ 12. The *practice/rehearsal* activities were in line with the objectives of the instruction.

_____ 13. I was given enough *practice/rehearsal* exercises.

_____ 14. The *help/feedback* was informative.

_____ 15. The *help/feedback* was easy to follow and understand.

_____ 16. The *help/feedback* was thorough..

_____ 17. The *procedures* were clearly described and illustrated.

_____ 18. The *information* was organized from simple to complex.

_____ 19. The *freeplay* (explorative learning) helped me understand the concepts better.

_____ 20. The *graphic simulations* helped me understand the interrelationships between radar system components.

_____ 21. The *graphic simulations* helped me visualize the correct sequence of

actions.

_____ 22. This automated training program has just the right amount of *text*.

| 1 | 2 | 3 | 4 | 5 |

Strongly
Disagree Disagree Undecided Agree Strongly
Agree
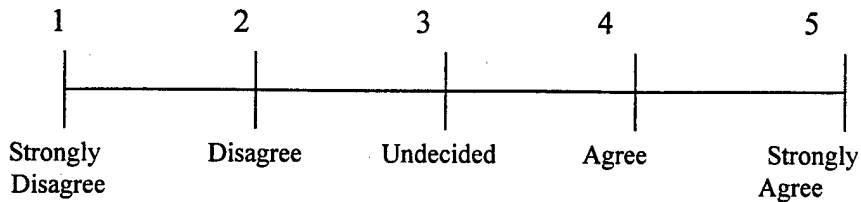
_____ 23. This automated training program has just the right amount of *graphics*.

_____ 24. This automated training program has just the right amount of *audio*.

_____ 25. This automated training program has just the right amount of *video*.

_____ 26. This automated training program has just the right amount of *simulation practice exercises*.

_____ 27. I would take a course like this in the *future* if given the choice.

_____ 28. The tutor *interface* was easy to use.

_____ 29. Working with another student on the tutor helped me *learn* the material.

_____ 30. I would take a course like this in the *future* if I were to be paired with a student.

_____ 31. I *prefer* this type of simulation based training to the lecture method of training.

_____ 32. I believe learners are likely to be *satisfied* from this learning experience.

_____ 33. The course met my *expectations*.

34. Have you ever taken a course like this *before* (computer administered)?
    a. Yes   b. No

35. Use the space provided below to comment about things that you specifically
    liked or *disliked* about the course.

Appendix H
Concept Pairs

JUNT Student Number: _____

Date:_____

Please Circle One: Pretest   or   Posttest

Your task in this experiment will involve judging the relatedness of pairs of concepts. In making these types of judgments, there are several ways to think about the items being judged. For instance, two concepts might be related because they share common features or because they frequently occur together. While this kind of detailed analysis is possible, our concern is to obtain your initial impression of "overall relatedness."   Therefore, please base your ratings on your first impression of relatedness.

Each pair of concepts will be presented on the screen along with a "relatedness" scale. You are to indicate your judgment of relatedness for each pair by circling the number on the scale to the right of the pair of concepts. If you feel that the concepts are not related at all circle "0." If you feel the concepts are highly related you would circle a "4" or a "5". You can think of these numbers as points along a "relatedness" scale, with higher numbers representing greater relatedness. If you wish to change your response, simply mark out the your initial response and circle the desired number.

			Not Related	Slightly Related			Highly Related	
1.	angle	heading marker correction	0	1	2	3	4	5
2.	dead reckoning	radar fixes	0	1	2	3	4	5
3.	azimuth stabilization	heading marker correction	0	1	2	3	4	5
4.	glitter	chart	0	1	2	3	4	5
5.	glitter	azimuth stabilization	0	1	2	3	4	5
6.	radar fixes	radarscope	0	1	2	3	4	5
7.	radarscope	chart	0	1	2	3	4	5
8.	angle	North-up	0	1	2	3	4	5
9.	dead reckoning	radarscope	0	1	2	3	4	5
10.	heading marker correction	radar fixes	0	1	2	3	4	5
11.	radarscope	angle	0	1	2	3	4	5
12.	dead reckoning	glitter	0	1	2	3	4	5
13.	pulse length error	radar fixes	0	1	2	3	4	5
14.	angle	dead reckoning	0	1	2	3	4	5
15.	North-up	radarscope	0	1	2	3	4	5
16.	azimuth stabilization	angle	0	1	2	3	4	5
17.	radar fixes	chart	0	1	2	3	4	5
18.	chart	heading marker correction	0	1	2	3	4	5
19.	dead reckoning	pulse length error	0	1	2	3	4	5
20.	chart	angle	0	1	2	3	4	5
21.	radar fixes	azimuth stabilization	0	1	2	3	4	5
22.	pulse length error	glitter	0	1	2	3	4	5
23.	glitter	angle	0	1	2	3	4	5
24.	North-up	pulse length error	0	1	2	3	4	5
35.	pulse length error	chart	0	1	2	3	4	5
26.	chart	North-up	0	1	2	3	4	5
27.	angle	pulse length error	0	1	2	3	4	5

39

28.	heading marker correction	North-up	0	1	2	3	4	5
29.	North-up	radar fixes	0	1	2	3	4	5
30.	dead reckoning	azimuth stabilization	0	1	2	3	4	5
31.	pulse length error	radarscope	0	1	2	3	4	5
32.	heading marker correction	pulse length error	0	1	2	3	4	5

			Not Related	Slightly Related			Highly Related	
33.	North-up	dead reckoning	0	1	2	3	4	5
34.	chart	dead reckoning	0	1	2	3	4	5
35.	pulse length error	azimuth stabilization	0	1	2	3	4	5
36.	radarscope	azimuth stabilization	0	1	2	3	4	5
37.	radar fixes	glitter	0	1	2	3	4	5
38.	angle	radar fixes	0	1	2	3	4	5
39.	azimuth stabilization	chart	0	1	2	3	4	5
40.	radarscope	heading marker correction	0	1	2	3	4	5
41.	heading marker correction	glitter	0	1	2	3	4	5
42.	azimuth stabilization	North-up	0	1	2	3	4	5
43.	heading marker correction	dead reckoning	0	1	2	3	4	5
44.	North-up	glitter	0	1	2	3	4	5
45.	glitter	radarscope	0	1	2	3	4	5

Thank you.